June 9 there will be a discussion on trade and technical schools, and on the evening of the same day the annual dinner of the association will be held at Anderton's Hotel, Fleet Street, E.C. All interested in technical education are cordially invited to attend the meetings and discussions.

WE learn from the *Pioneer Mail* that the Government of the Maharaja of Mysore is about to award four scholarships—of which two will be for mining and metallurgy, including electrometallurgy—of the value of 200*l.* each per annum, for the year 1908, for study in some British or other recognised university or approved technical institution. These scholarships will be open to all Indians who have taken with credit a degree in arts, medicine, or engineering in an Indian or other recognised university, provided that when qualifications are otherwise equal preference shall be given to candidates who are natives of Mysore or who have taken a degree from a Mysore college. The selection of candidates will be made in August. From the same source we notice that, of 157 students selected in the past three years by the Association for the Advancement of Scientific and Industrial Education of Indians to proceed to foreign countries, 100 have availed themselves of the opportunity, while the fifteen returned students have all found suitable employment.

THE second volume of the report of the U.S. Commissioner of Education for the year ending June 30, 1906, is now available. It gives a very prominent place to statistical information, designed to show the progress which continues to be made in American secondary education. School education in the States is divided according to a well-devised scheme of studies into twelve grades, and the first eight constitute what, in this country, would be called elementary education, and the grades from nine to twelve inclusive correspond to our secondary schools. The number of American secondary-school pupils in both public and private institutions in 1890 was 367,000, or about 5900 to the million of population; in 1895 the number had increased to 539,700, or 7900 to the million; in 1900 the number was 719,200, or 9500 to the million; while for the year 1906 the number aggregated 924,400, or about 11,000 to the million of population, or more than 1 per cent. The growth of public, as compared with private, secondary schools has been remarkable. The number of public schools, which in 1890 was 2526, had in 1906 grown to 8031, and they educated 87·66 per cent. of the total number of secondary-school pupils. On the other hand, the number of private secondary schools, which increased up to 1895, has since that time steadily decreased. In 1906 the number of private schools was 1529. Of the public secondary schools of the country, there were forty for boys only and twenty-nine for girls only, all the others being co-educational. Of the private schools, 304 were for boys only, 500 for girls only, and 725 co-educational.

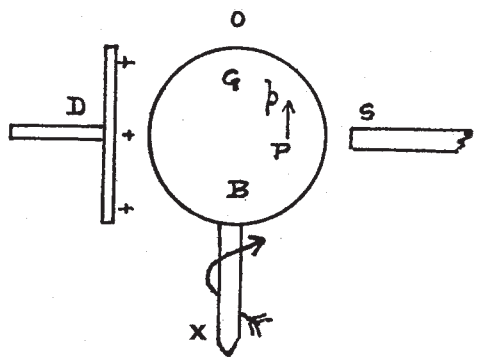
THE annual report of the superintendent of education of the public schools of Nova Scotia for the year ended July 31, 1907, contains, with much other useful information, reports on technical education by the director, Prof. F. H. Sexton, and on the Nova Scotia College of Agriculture by its principal, Mr. Melville Cumming. On April 25, 1907, an Act relating to technical education passed the Nova Scotia Legislature, and led to Prof. Sexton's appointment as director of technical education, with charge of all the schools established under the Act. The schools provided for are:—(i.) a technical college in the capital city of Halifax, to provide professional training in mining, in civil, electrical, metallurgical, and mechanical engineering, and in industrial scientific research generally; (ii.) local technical schools to be established in various industrial centres; (iii.) coal-mining and engineering schools in colliery centres. The college is to be supported by the Government solely, and by private benefactions if such become available. The expenses of the coal-mining and engineering schools are at present defrayed altogether by the provincial treasury, and the local technical schools are supported jointly by the locality and the central government. The first step in organisation was to obtain information regarding the status of existing mining and engineering schools, and the attitude of workmen, employers, and local authorities towards the proposed local technical schools. The engineering schools seem to have been conducted in such a manner that they fulfilled most of the demands on them, and up to the end of the period with which the report deals it was not considered necessary to engage instructors to devote their whole time to teaching. In respect of the local technical schools, the greatest interest was found exhibited everywhere by wage-earners, employers, and the general public. Trades unions were found to be definitely opposed to pure trade schools; the unions fear that such schools will give an imperfect knowledge of the trades, produce a surplus of "hot-house mechanics," as they designate them, who will tend to decrease the demand and wages of skilled labour. It was finally decided that the first schools to be established should be evening technical schools to educate the men already employed in the scientific principles underlying their trades. The report on the College of Agriculture shows that the number of students in 1907 reached 132, and that it is expected the total will reach 200 during the present year.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, January 30.—"On the Generation of a Luminous Glow in an Exhausted Receiver moving in an Electrostatic Field, and the Action of a Magnetic Field on the Glow so Produced." By F. J. **Jervis-Smith**, F.R.S.

A glass bulb, exhausted as a Röntgen tube, was rotated in an electrostatic field and also in a magnetic field. The conditions of the experiment were varied in six ways. The static charge was either positive or negative. The direction of rotation was reversible. The pole maintaining the magnetic field was either S. or N. The relationship existing between the different conditions will be best understood by reference to the diagram, in which D is a charged disc, B the glow-bulb, S the magnet pole. The axis XO of rotation of the glow-bulb B, the axis of the electromagnet, and the stem of the inductor disc D, are situated in the same plane, when the glow-bulb B



rotates about the axis XO in a clock-hands' sense to an eye looking along XO. The metal inductor D being charged positively, it is filled with a luminous glow of a bluish-green colour, but when the S. pole is placed near the bulb the glow matter is deflected in the direction Pp, and a bright patch of light is produced at G. The charge on D can be reversed, also the direction of rotation and the magnet pole. If while any two of these conditions are kept the same the third is reversed, the direction of deflection of the glow is reversed. The glow-bulbs were exhausted to the same degree of exhaustion as the Röntgen tube by a leading maker of such tubes. The rays emitted have a definite effect on a sensitive photographic plate, giving shadow pictures. The glow-bulb was rotated about twenty times per second; it was found that the intensity of the glow increased as the rotation increased. The distance between the charged inductor and the glow-bulb was varied from 1 cm. to 13 cm. The glow was apparent at 13 cm. In most of the experiments the inductor was charged to about 1200 volts. The diameter of the glow-bulbs varied from 1·5 cm. to 5·0 cm.

February 20.—"Effects of Self-induction in an Iron Cylinder when traversed by Alternating Currents." By Prof. E. **Wilson.** Communicated by Sir William Preece, F.R.S.

Alternating currents up to about 2000 amperes at frequencies varying from 1/45 to 1/360 were supplied to an iron cylinder 10 inches in diameter, and the change of magnetic induction at different depths was obtained from readings taken with three dead-beat galvanometers connected to coils threaded through holes in the cylinder. The total current in the cylinder was observed on an amperemeter in the circuit. The curves of E.M.F. in the exploring coils were plotted, and by integration the magnetic induction at different depths was obtained. The results show that the effect due to internal self-induction, commonly called "skin effect," is greater the greater the average permeability, and it is shown how it depends upon change of current and frequency. The phase displacement of the E.M.F. curves reckoned from zero of current diminishes with increase of current for a given frequency, and increases with increase of frequency for a given current. From the hysteresis loops of the material the total currents interior to the respective radii were found and plotted against radius as distribution curves, from which the C^2R loss was calculated. The hysteresis watts were also found, and both compared with the watts which would occur if the distribution under continuous current were assumed to persist. For a given frequency, the ratio of the C^2R loss with alternating to those with continuous currents is greater the higher the average permeability. For a given current, the C^2R loss increases with frequency, and the hysteresis loss tends to increase with frequency, but to diminish owing to increased skin effect. The results hold for a cylinder of n times the diameter if the current is varied as n, and the frequency inversely as n^2. The paper contains tables of figures and curves.

"On the Refractive Indices of Gaseous Nitric Oxide, Sulphur Dioxide, and Sulphur Trioxide." By C. **Cuthbertson** and E. Parr **Metcalfe.** Communicated by Prof. F. T. Trouton, F.R.S.

The refractive index of nitric oxide, purified by fractionation at low temperatures, was found to be 1·0002939 for sodium light. This is about 1 per cent. less than the value found by Mascart.

The index of sulphur dioxide was re-determined in view of the discrepancies between the numbers published by previous observers. The value now obtained, 1·0006609, is in agreement with the results of Ketteler and G. W. Walker, when these are corrected for the density of the gas at 0° C. and 760 mm. The index of sulphur trioxide is, approximately, 1·000737. Both this and the index of sulphur dioxide are considerably below the additive values.

Faraday Society, April 28.—Prof. A. K. Huntington, vice-president, in the chair.—The planimetric analysis of alloys, and the structure of phosphor-copper: A. K. **Huntington** and C. H. **Deach.** The conditions under which it is possible to estimate the relative proportions of the constituent metals in an alloy by means of the planimetric measurement of the areas of the solid phases exposed in a polished and etched micro-section is discussed. Details of the method are given, and its accuracy is shown by a series of measurements of analysed alloys. The method has been most fully studied in the case of phosphor-copper, of which a number of photomicrographs are shown. In the case of alloys containing less than the eutectic proportion of phosphorus, however, the area of copper crystals is found to be considerably greater than that calculated from the composition determined by analysis. The origin of the discrepancies was traced to the segregation of the eutectic, the copper crystals which separate at first drawing to themselves a portion of the copper of the surrounding eutectic. The crystals are therefore surrounded by a belt of copper phosphide. By measuring the area of this belt, and thence calculating the amount of segregated copper, a correction may be applied to the area of the crystals, and a very satisfactory agreement with the analytical results is thus obtained.—The interaction of aluminium powder and carbon: F. E. **Weston** and H. R. **Ellis.** Very little work has been done on the combination of aluminium and carbon at temperatures lower than that of the electric furnace. The authors now show that aluminium powder and carbon can be made to react at temperatures much below that of the electric furnace. Mixtures of aluminium powder and carbon, wood charcoal, sugar carbon, and graphite have been prepared, in which reaction takes place by starting with a fuse of magnesium powder and barium peroxide, as in Goldschmidt's reaction; other mixtures have been made which only react when heated at temperatures varying from 400° C. to 1000° C. In all cases the products of reaction were found to be aluminium carbide (9·12 per cent. to 65·91 per cent.), aluminium nitride (3·67 per cent. to 42·16 per cent.), alumina (11·07 per cent. to 55·4 per cent.), aluminium, and carbon. The carbide produced is most probably that described by Moissan as aluminium carbide, C_3Al_4, since the gas obtained on treating the product of reaction with either water or hydrochloric acid was found to consist of CH_4 and H, the latter coming from (1) the action of HCl in unaltered aluminium; (2) action of NH_3 on aluminium, the NH_3 being formed by the action of water on aluminium nitride.

Mathematical Society, May 14.—Prof. W. Burnside, president, in the chair.—The invariants of the general linear homographic transformation in two variables: Major P. A. **MacMahon.**—The order of the group of isomorphisms of an Abelian group: H. **Hilton.**—The calculation of the normal modes and frequencies of vibrating systems (preliminary note): Prof. A. E. H. **Love.**—A question in probability: Prof. J. E. A. **Steggall.**

PARIS.

Academy of Sciences, May 11.—M. H. Becquerel in the chair.—The president announced the death of M. Albert de Lapparent.—A planimeter permitting of the integration of the Abelian equation $yy'=Ay^2+By+C$: Col. **Jacob.** This form of equation occurs in the study of ballistics.—The application of the laws of similitude to the propagation of detonations: MM. **Crussard** and **Jouguet.**—Wireless telegraphy with directed waves: MM. **Bellini** and **Tosi.** The direction of the waves is obtained by the use of aërial conductors formed of closed oscillating circuits disposed in vertical planes without connection with the earth. The transmitter was installed at Dieppe, and two receiving posts were constructed, one at Havre and the other at Harfleur. The signals could be transmitted to either receiving station, and were received only by the station to which they were directed. The signals neither interfere with nor are interfered with by other systems of wireless messages.—The range of the α rays: William **Duane.** It has been shown by various observers that the photographic, phosphorescent, and ionising action of the α rays cease abruptly when the rays have traversed a few centimetres in air, and in the present paper experiments are described which were made with the object of deciding whether the other actions of these rays cease at the same distance. From the form of the curves obtained it is very difficult to decide the exact point at which the range of the α rays ceases, but it was found that the charge of the α particles and their ionisation ceases at the same point.—The electric dispersion of water: F. **Beaulard.** By extending the range of the method previously described to other wave-lengths, there would appear to be some anomalous electric dispersion for the order of magnitude of the electric field studied.—The spectrum of iron observed in the flame of the oxyhydrogen blow-pipe: G. A. **Hemsalech** and C. **de Watteville.** Using the method previously described, the gases feeding the flame were supplied with finely divided particles of the metal torn from electrodes by the electric spark. A table of the wave-lengths and intensities of the observed lines is given, and the results compared with the arc spectrum of iron.—Contribution to the study of the photographic grating: H. **Calmels** and L. P. **Clerc.**—Molecular agitation and the Brownian movement: Jean **Perrin.** An attempt to prove that molecular agitation is the cause of the Brownian motion. It results from the proof given that the number of molecules per gram of liquid is of the order $6·7\times10^{23}$.—An electro-optic phenomenon in air containing dust in suspension: Eugène **Bloch.**—The commensurability of the atomic weights: M. **Hinrichs.**—

Thorium fluoride and oxyfluoride: Ed. **Chauvenet.** When hydrated thorium fluoride is heated to about 800° in a current of pure dry HF, thorium oxyfluoride, $ThOF_2$, remains. The fluoride, ThF_4, can be obtained by the action of anhydrous gaseous hydrofluoric acid on thorium bromide.—The combinations of silver selenide and the selenides of arsenic, antimony, and bismuth: H. **Pélabon.** The existence of compounds of these selenides is deduced from a study of the fusibility curves of their mixtures.—The origin of atmospheric ozone and the causes of the variation of carbonic acid in the air: H. **Henriet** and M. **Bonyssy.** Ozone is produced by the ultra-violet rays of the sun in the upper atmosphere, and the amount near the earth increases when air currents set in from these upper regions. The reduction in carbon dioxide found to accompany an increase in ozone is an indirect effect, due to simple dilution of the lower air with the purer air of the higher atmosphere.—The properties of starch in relation to its colloidal form: E. **Fouard.** A study of starch solutions after filtering through collodion films of different permeabilities.—The properties of the metallic thiosulphocarbamates: Marcel **Delépine.**—Contribution to the study of the amido-derivatives of *o*-dibenzoylbenzene: A. **Guyot** and P. **Pignet.**—A new method of tanning: Louis **Meunier** and Alphonse **Seyewetz.** Skin can be tanned with quinone or quinhydrone. Skins thus tanned present great affinity for both acid and basic colouring matters.—The thermal effects of high-frequency currents on the organism: A. **Zimmern** and S. **Turchini.** Experiments made in dogs and men show that a rise of the body temperature of between 0°·1 and 0°·4 is caused by high-frequency currents. As a method of thermotherapy, the authors regard this method as much preferable to the external methods in current use (hot baths, sun baths, &c.). The application to certain circulatory troubles is indicated.—Researches on the distribution of the antivirulent substance in the humours of vaccinated animals: L. **Camus.**—A new Oospora (*Oospora lingualis*) associated with *Cryptococcus linguae-pilosae* in black tongue: Fernand **Guéguen.**—The formation and disappearance of acetaldehyde under the influence of alcoholic yeasts: A. **Trillat** and M. **Sauton.** Experiments are cited showing the formation of aldehyde under the action of yeast; the reverse action also takes place, since when aldehyde is gradually added to an alcoholic liquid containing fresh yeast in suspension, the aldehyde disappears.—The nutritive value of some peptones for different microbial species: H. **Dunschmann.** Comparisons were made of the nutritive action of Dufresne, Martin, and vegetable peptone on cultures of typhoid, *Bacterium coli*, anthrax, and diphtheria.

DIARY OF SOCIETIES.

THURSDAY, MAY 21.

ROYAL SOCIETY, at 4.30.—On Some Features in the Hereditary Transmission of the Albino Character and the Black Piebald Coat in Rats. II.: G. P. Mudge.—A Further Note on the Nutrition of the Early Embryo, with Special Reference to the Chick: E. Emrys-Roberts.—The Antagonistic Action of Calcium upon the Inhibitory Effect of Magnesium: S. J. Meltzer and J. Auer.

ROYAL INSTITUTION, at 3.—The Chemistry of Photography: Dr. Alexander Scott, F.R.S.

ROYAL SOCIETY OF ARTS, at 4.30.—The United Provinces of Agra and Oudh: Sir J. J. D. La Touche, K.C.S.I.

CHEMICAL SOCIETY, at 8.30.—Hydroaromatic Ketones, Preliminary Note: A. W. Crossley and C. Gilling.—Titani-dihydroxymaleic Acid, and the Detection of Titanium: H. J. H. Fenton.—Some Experiments on Carbon at High Temperatures and Pressures, and Apparatus Therefor: R. Threlfall.—The Sulphides and Oxy-sulphides of Silicon: I. G. Rankin and S. M. Revington.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Recent Progress in Tungsten Metallic Filament Lamps: H. Hirst.

INSTITUTION OF MINING AND METALLURGY, at 8.—The Electrical Equipment of Gold Mines (*continued discussion*): H. J. S. Heather.—The Behaviour of Tellurium in Assaying: S. W. Smith.—The Average Rate of Accumulation and Absorption of Gold Amalgam by Copper Plates: E. Hatch.—The Absorption and Accumulation of Gold on Copper Plates: W. F. A. Thomae.—A Journey to Central Asia: A. Adiassewich.

FRIDAY, MAY 22.

ROYAL INSTITUTION, at 9.—Recent Researches in the Structure of the Universe: Prof. J. C. Kapteyn.

PHYSICAL SOCIETY, at 5.—On the Spectrum Top: G. P. Sexton.—On the Coefficient of Diffusion: B. W. Clack.—On the Production of Small Alternating Currents of Variable Frequency suitable for Telephonic and other Measurements: B. S. Cohen.

MONDAY, MAY 25.

LINNEAN SOCIETY, at 8.—Anniversary meeting.

ROYAL GEOGRAPHICAL SOCIETY, at 3.—Anniversary meeting.

TUESDAY, MAY 26.

ROYAL INSTITUTION, at 3.—Animal Heat and Allied Phenomena: Prof. William Stirling.

ZOOLOGICAL SOCIETY, at 8.30.—The Rudd Exploration of South Africa. X. List of Mammals collected by Mr. Grant near Tette, Zambesia: Oldfield Thomas, F.R.S., and R. C. Wroughton.—Zoological Results of the Third Tanganyika Expedition, conducted by Dr. W. A. Cunnington, 1904-5. Report on the Isopoda Terrestria: Rev. T. R. R. Stebbing, F.R.S.—On the Anatomy of Antechinomys and some other Marsupials, with Especial Reference to the Intestinal Tract and Mesenteries of These and other Mammals: F. E. Beddard, F.R.S.—The Armour of the Extinct Reptiles of the Genus Pareiasaurus: Prof. H. G. Seeley, F.R.S.—New Siphonaptera: Hon. N. Charles Rothschild.

FARADAY SOCIETY, at 8.—Presidential Address: Some Aspects of the Work of Lord Kelvin: Sir Oliver Lodge, F.R.S.

WEDNESDAY, MAY 27.

BRITISH ASTRONOMICAL ASSOCIATION, at 5.

THURSDAY, MAY 28.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* On the Theory of Capillarity: Prof. E. T. Whittaker, F.R.S.—Effect of a Cross Wind on Rifled Projectiles: A. Mallock, F.R.S.—Transparent Silver and other Metallic Films: Prof. T. Turner.

ROYAL INSTITUTION, at 3.—The Chemistry of Photography: Dr. Alexander Scott, F.R.S.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.

FRIDAY, MAY 29.

ROYAL INSTITUTION, at 9.—Ancient and Mediæval Projectile Weapons other than Firearms: Sir Ralph Payne-Gallwey, Bart.

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